

PLEASE AMEND THE SPECIFICATION AS FOLLOWS:

Page 10 line 21 change "20" to --120--.

PLEASE ADD CLAIMS AS FOLLOWS:

- 5 32. An apparatus to remove echo and crosstalk interference in a  
communication system having a receiver and a transmitter for  
simultaneous reception from and transmission to a communication  
medium, said apparatus comprising:
- 10 an adaptive correlator in communication with the communication  
medium to generate a plurality of filter coefficients each period of  
time representing echo and crosstalk interference on a signal  
received by the receiver, wherein the plurality of filter coefficients  
for a current time period are a weighted sum of corresponding  
coefficients from a previous time period and a product of a signal  
15 received by the receiver during the current period and a signal  
transmitted by the transmitter delayed by a predetermined time;  
and
- 20 a finite impulse filter in communication with the receiver to filter the  
echo and crosstalk in accordance with the plurality of filter  
coefficients generated by said adaptive correlator.

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33. An apparatus according to Claim 32, wherein the corresponding coefficients from the previous time period are weighted by a first predetermined weighing factor.

5 34. An apparatus according to Claim 32, wherein the product of the signal received by the receiver during the current period and the signal transmitted by the transmitter delayed by the predetermined time are weighted by a second predetermined weighing factor.

10 35. An apparatus according to Claim 32, wherein said adaptive correlator comprises:

a first delay circuit to delay the signal transmitted by the transmitter;

a first multiplier to multiply the signal received by the receiver during the current period with an output of said first delay circuit;

15 a second multiplier to multiply an output of said first multiplier by a first predetermined weighing factor;

a first adder;

a second delay circuit to delay an output of said first adder; and

20 a third multiplier to multiply an output of said second delay circuit by a second predetermined weighing factor,

wherein said first adder adds an output of said second multiplier to an output of said third multiplier.

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36. An apparatus according to Claim 35, wherein the first predetermined weighting factor is a quotient of the second predetermined weighting factor divided by a variance of the signal transmitted by the transmitter.

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37. An apparatus according to Claim 35, wherein the second predetermined weighting factor is an inverse of a number of a group of the signals transmitted by the transmitter.

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38. An apparatus according to Claim 32, wherein said adaptive correlator comprises:

a first delay circuit to delay the signal transmitted by the transmitter;

a first shifter to shift the signal received by the receiver during the current period in accordance with an output of said first delay circuit;

a second shifter to shift an output of said first shifter in accordance with a first predetermined weighting factor;

a first adder;

a third shifter to shift an output of said first adder in accordance with a second predetermined weighting factor;

a second adder; and

a second delay circuit to delay an output of said second adder,

wherein said first adder adds an output of said second shifter to an output of said second delay circuit, and

wherein said second adder adds an output of said third shifter to the output of said second delay circuit.

39. An apparatus according to Claim 38, wherein the first predetermined weighting factor is an inverse of a variance of the signal transmitted by the transmitter.

40. An apparatus according to Claim 38, wherein the second predetermined weighting factor is an inverse of a number of groups of the signals transmitted by the transmitter.

41. A communication apparatus comprising:

a transmitter;

a receiver;

an adaptive correlator in communication with a communication medium

to generate a plurality of filter coefficients each period of time

representing echo and crosstalk interference on a signal received

by said receiver, wherein the plurality of filter coefficients for a

current time period are a weighted sum of corresponding

coefficients from a previous time period and a product of a signal

received by said receiver during the current period and a signal

transmitted by said transmitter delayed by a predetermined time;

and

a finite impulse filter in communication with said receiver to filter the

echo and crosstalk in accordance with the plurality of filter

coefficients generated by said adaptive correlator,

wherein said receiver receives a signal from said finite impulse filter

simultaneously with the transmission of a signal by said transmitter

on the medium.

42. An apparatus according to Claim 41, wherein the corresponding
- coefficients from the previous time period are weighted by a first
- predetermined weighing factor.

43. An apparatus according to Claim 41, wherein the product of the signal received by said receiver during the current period and the signal transmitted by said transmitter delayed by the predetermined time are weighted by a second predetermined weighing factor.

44. An apparatus according to Claim 41, wherein said adaptive correlator comprises:

a first delay circuit to delay the signal transmitted by said transmitter;

a first multiplier to multiply the signal received by said receiver during the current period with an output of said first delay circuit;

a second multiplier to multiply an output of said first multiplier by a first predetermined weighting factor;

a first adder;

a second delay circuit to delay an output of said first adder; and

a third multiplier to multiply an output of said second delay circuit by a second predetermined weighting factor,

wherein said first adder adds an output of said second multiplier to an output of said third multiplier.

45. An apparatus according to Claim 44, wherein the first predetermined weighting factor is a quotient of the second predetermined weighting factor divided by a variance of the signal transmitted by said transmitter.

5 46. An apparatus according to Claim 44, wherein the second predetermined weighting factor is an inverse of a number of a group of the signals transmitted by said transmitter.

47. An apparatus according to Claim 41, wherein said adaptive correlator comprises:

10 a first delay circuit to delay the signal transmitted by said transmitter;

a first shifter to shift the signal received by said receiver during the current period in accordance with an output of said first delay circuit;

15 a second shifter to shift an output of said first shifter in accordance with a first predetermined weighting factor;

a first adder;

a third shifter to shift an output of said first adder in accordance with a second predetermined weighting factor;

20 a second adder; and

a second delay circuit to delay an output of said second adder,  
wherein said first adder adds an output of said second shifter to an  
output of said second delay circuit, and  
wherein said second adder adds an output of said third shifter to the  
output of said second delay circuit.

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48. An apparatus according to Claim 47, wherein the first predetermined  
weighting factor is an inverse of a variance of the signal transmitted by  
said transmitter.

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49. An apparatus according to Claim 47, wherein the second predetermined  
weighting factor is an inverse of a number of groups of the signals  
transmitted by said transmitter.

15 50. A communication system comprising:

a first transceiver comprising:

a first hybrid;

a first transmitter in communication with said first hybrid;

a first receiver;



5 a first adaptive correlator in communication said first hybrid to  
generate a first plurality of filter coefficients each period of time  
representing echo and crosstalk interference on a signal  
received by said first receiver, wherein the first plurality of filter  
coefficients for a current time period are a weighted sum of  
corresponding coefficients from a previous time period and a  
product of a signal received by said first receiver during the  
current period and a signal transmitted by said first transmitter  
delayed by a predetermined time; and

10 a first finite impulse filter in communication with said first receiver to  
filter echo and crosstalk in accordance with the first plurality of  
filter coefficients generated by said first adaptive correlator,  
wherein said first receiver receives a signal from said first finite  
impulse filter simultaneously with the transmission of a signal by  
15 said first transmitter to said first hybrid; and

a second transceiver comprising:

a second hybrid in communication with said first transceiver via a  
communication medium;

a second transmitter in communication with said second hybrid;

20 a second receiver;

a second adaptive correlator in communication said second hybrid  
to generate a second plurality of filter coefficients each period of

time representing echo and crosstalk interference on a signal received by said second receiver, wherein the second plurality of filter coefficients for a current time period are a weighted sum of corresponding coefficients from a previous time period and a product of a signal received by said second receiver during the current period and a signal transmitted by said second transmitter delayed by a predetermined time; and

a second finite impulse filter in communication with said second receiver to filter the echo and crosstalk in accordance with the second plurality of filter coefficients generated by said second adaptive correlator,

wherein said second receiver receives a signal from said second finite impulse filter simultaneously with the transmission of a signal by said second transmitter to said second hybrid.

51. An apparatus to remove echo and crosstalk interference in a communication system having a receiver and a transmitter for simultaneous reception from and transmission to a communication medium, said apparatus comprising:

adaptive correlating means in communication with the communication medium for generating a plurality of filter coefficients each period of time representing echo and crosstalk interference on a signal

received by the receiver, wherein the plurality of filter coefficients for a current time period are a weighted sum of corresponding coefficients from a previous time period and a product of a signal received by the receiver during the current period and a signal transmitted by the transmitter delayed by a predetermined time; and

finite impulse filtering means in communication with the receiver for filtering the echo and crosstalk in accordance with the plurality of filter coefficients generated by said adaptive correlating means.

52. An apparatus according to Claim 51, wherein the corresponding coefficients from the previous time period are weighted by the first predetermined weighing factor.

53. An apparatus according to Claim 51, wherein the product of the signal received by the receiver during the current period and the signal transmitted by the transmitter delayed by the predetermined time are weighted by a second predetermined weighing factor.

54. An apparatus according to Claim 51, wherein said adaptive correlating means comprises:

first delay means for delaying the signal transmitted by the transmitter;

first multiplying means for multiplying the signal received by the receiver during the current period with an output of said first delay means;

second multiplying means for multiplying an output of said first multiplying means by the first predetermined weighting factor;

first adding means;

second delay means for delaying an output of said first adding means; and

third multiplying means for multiplying an output of said second delay means by second predetermined weighting factor,

wherein said first adding means adds an output of said second multiplying means to an output of said third multiplying means.

55. An apparatus according to Claim 54, wherein the first predetermined weighting factor is a quotient of the second predetermined weighting factor divided by a variance of the signal transmitted by the transmitter.

56. An apparatus according to Claim 54, wherein the second predetermined weighting factor is an inverse of a number of a group of the signals transmitted by the transmitter.

5 57. An apparatus according to Claim 51, wherein said adaptive correlating means comprises:

first delay means for delaying the signal transmitted by the transmitter;

first shifting means for shifting the signal received by the receiver  
during the current period in accordance with an output of said first  
delay means;

second shifting means for shifting an output of said first shifting means  
in accordance with first predetermined weighting factor;

first adding means;

third shifting means for shifting an output of said first adding means in  
accordance with the second predetermined weighting factor;

second adding means; and

second delay means for delaying an output of said second adding  
means,

wherein said first adding means adds an output of said second shifting  
means to an output of said second delay means, and

wherein said second adding means adds an output of said third shifting means to the output of said second delay means.

5 58. An apparatus according to Claim 57, wherein the first predetermined weighting factor is an inverse of a variance of the signal transmitted by the transmitter.

10 59. An apparatus according to Claim 57, wherein the second predetermined weighting factor is an inverse of a number of groups of the signals transmitted by the transmitter.

60. A communication apparatus comprising:

transmitting means for transmitting a signal;

receiving means for receiving a signal;

15 adaptive correlating means in communication with a communication medium for generating a plurality of filter coefficients each period of time representing echo and crosstalk interference on a signal received by said receiving means, wherein the plurality of filter coefficients for a current time period are a weighted sum of

corresponding coefficients from a previous time period and a product of a signal received by said receiving means during the current period and a signal transmitted by said transmitting means delayed by a predetermined time; and

5 finite impulse filtering means in communication with said receiving means for filtering the echo and crosstalk in accordance with the plurality of filter coefficients generated by said adaptive correlating means,

wherein said receiving means receives a signal from said finite impulse  
10 filtering means simultaneously with the transmission of a signal by said transmitting means on the medium.

61. An apparatus according to Claim 60, wherein the corresponding coefficients from the previous time period are weighted by the first  
15 predetermined weighing factor.

62. An apparatus according to Claim 60, wherein the product of the signal received by said receiving means during the current period and the signal transmitted by said transmitting means delayed by the predetermined time  
20 are weighted by second predetermined weighing factor.

63. An apparatus according to Claim 60, wherein said adaptive correlating means comprises:

first delay means for delaying the signal transmitted by said transmitting means;

first multiplying means for multiplying the signal received by said receiving means during the current period with an output of said first delay means;

second multiplying means for multiplying an output of said first

multiplying means by the first predetermined weighting factor;

first adding means;

second delay means for delaying an output of said first adding means;

and

third multiplying means for multiplying an output of said second delay

means by second predetermined weighting factor,

wherein said first adding means adds an output of said second

multiplying means to an output of said third multiplying means.

64. An apparatus according to Claim 63, wherein the first predetermined weighting factor is a quotient of the second predetermined weighting factor divided by a variance of the signal transmitted by said transmitting means.



65. An apparatus according to Claim 63, wherein the second predetermined weighting factor is an inverse of a number of a group of the signals transmitted by said transmitting means.

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66. An apparatus according to Claim 60, wherein said adaptive correlating means comprises:

first delay means for delaying the signal transmitted by said transmitting means;

10 first shifting means for shifting the signal received by said receiving means during the current period in accordance with an output of said first delay means;

second shifting means for shifting an output of said first shifting means in accordance with first predetermined weighting factor;

15 first adding means;

third shifting means for shifting an output of said first adding means in accordance with the second predetermined weighting factor;

second adding means; and

20 second delay means for delaying an output of said second adding means,

wherein said first adding means adds an output of said second shifting means to an output of said second delay means, and  
wherein said second adding means adds an output of said third shifting means to the output of said second delay means.

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67. An apparatus according to Claim 66, wherein the first predetermined weighting factor is an inverse of a variance of the signal transmitted by said transmitting means.

10 68. An apparatus according to Claim 66, wherein the second predetermined weighting factor is an inverse of a number of groups of the signals transmitted by said transmitting means.

15 69. An communication system comprising:  
first transceiver means comprising:  
first hybrid means for combining a received signal with transmitted signal;  
first transmitting means for transmitting a transmitted signal to said first hybrid means;

first receiving means for receiving a received signal;

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first adaptive correlating means in communication said first hybrid  
means for generating first plurality of filter coefficients each  
period of time representing echo and crosstalk interference on a  
signal received by said first receiving means, wherein the first  
plurality of filter coefficients for a current time period are a  
weighted sum of corresponding coefficients from a previous  
time period and a product of a signal received by said first  
receiving means during the current period and a signal  
transmitted by said first transmitting means delayed by a  
predetermined time; and

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first finite impulse filtering means in communication with said first  
receiving means for filtering echo and crosstalk in accordance  
with the first plurality of filter coefficients generated by said first  
adaptive correlating means,

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wherein said first receiving means receives a signal from said first  
finite impulse filtering means simultaneously with the  
transmission of a signal by said first transmitting means to said  
first hybrid means; and

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second transceiver means comprising:

second hybrid means for combining a received signal transmitted  
from said first transceiver means via a communication medium

and a transmitted signal to said first transceiver means via a communication medium;

second transmitting means in communication with said second hybrid means;

second receiving means;

second adaptive correlating means in communication said second hybrid means for generating second plurality of filter coefficients

each period of time representing echo and crosstalk

interference on a signal received by said second receiving

means, wherein the second plurality of filter coefficients for a

current time period are a weighted sum of corresponding

coefficients from a previous time period and a product of a

signal received by said second receiving means during the

current period and a signal transmitted by said second

transmitting means delayed by a predetermined time; and

second finite impulse filtering means in communication with said

second receiving means for filtering the echo and crosstalk in

accordance with the second plurality of filter coefficients

generated by said second adaptive correlating means,

wherein said second receiving means receives a signal from said

second finite impulse filtering means simultaneously with the

transmission of a signal by said second transmitting means to  
said second hybrid means.

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70. A method to remove echo and crosstalk interference from a received  
signal that is simultaneous received with a transmitted signal, said method  
comprising the steps of:

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a) generating a plurality of filter coefficients each period of time  
representing echo and crosstalk interference on the received  
signal, wherein the plurality of filter coefficients for a current time  
period are a weighted sum of corresponding coefficients from a  
previous time period and a product of the received signal during the  
current period and a transmitted signal delayed by a predetermined  
time; and
- 15  
b) finite impulse filtering from the received signal the echo and  
crosstalk in accordance with the plurality of filter coefficients  
generated by said adaptive correlating means.

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71. A method according to Claim 70, wherein the corresponding coefficients  
from the previous time period are weighted by the first predetermined  
weighing factor.

72. A method according to Claim 70, wherein the product of the signal received by the receiver during the current period and the signal transmitted by the transmitter delayed by the predetermined time are weighted by a second predetermined weighing factor.

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73. A method according to Claim 70, wherein said generating step comprises the steps of:

- a) delaying the transmitted signal;
- b) multiplying the received signal during the current period with the delayed signal from step (a);
- c) multiplying an output of step (b) by the first predetermined weighing factor;
- d) adding an output of step (c) to an output of step (f);
- e) delaying an output of step (d); and
- f) third multiplying means for multiplying an output of step (e) by second predetermined weighing factor.

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74. A method according to Claim 73, wherein the first predetermined weighing factor is a quotient of the second predetermined weighing factor divided by a variance of the signal transmitted by the transmitter.

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75. A method according to Claim 73, wherein the second predetermined weighting factor is an inverse of a number of a group of the signals transmitted by the transmitter.

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76. A method according to Claim 70, wherein said generating step comprises the steps of:

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- a) delaying the transmitted signal;
  - b) shifting the received signal during the current period in accordance with an output of step (a);
  - c) shifting an output of step (b) in accordance with first predetermined weighting factor;
  - d) adding an output of step (c) to an output of step (g) ;
  - e) shifting an output of step (d) in accordance with the second  
15 predetermined weighting factor;
  - f) adding the output of step(g) to an output of step (e); and
  - g) delaying an output of step (f).